LAW OFFICES
GOLDBERG, GODLES, WIENER & WRIGHT
1229 NINETEENTH STREET, N.W.
WASHINGTON, D.C. 20036

HENRY GOLDBERG
JOSEPH A. GODLES
JONATHAN WIENER
HENRIETTA WRIGHT
W. KENNETH FERREE

THOMAS G. GHERARDI, P.C.
MARY J. DENT
COUNSEL

(202) 429-4900
TELECOPIER:
(202) 429-4912

e-mail:
general@g2w2.com

EX PARTE OR LATE FILED

November 4, 1998

EX PARTE

RECEIVED
NOV - 4 1998
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Ms. Magalie R. Salas, Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

Re: Docket No. ET 98-42
Ex Parte Presentation

Dear Ms. Salas:

This letter reports that on Wednesday, November 4, 1998, Mack Sullivan, Director of The Wireless LAN Alliance (WLANA), along with the undersigned, met with Julius Knapp, Karen Rackley, Tony Serafini and John Reed of the Office of Engineering and Technology to discuss issues concerning WLANA's position in the above referenced proceeding.

The items discussed are reflected in WLANA'a comments in this docket, and the attached documents that were handed out at the meeting.

If there are any questions in this regard, please contact the undersigned.

Respectfully,

Henrietta Wright

Henrietta Wright
Attorney for WLANA

cc: Julius Knapp
Karen Rackley
Tony Serafini
John Reed

Attachments

No. of Copies rec'd 0+1
List ABCDE

Wireless LAN Alliance (WLANA) urges FCC to consider impact of Part 18 rule changes on wireless LANs

11/04/98

Mack Sullivan, Director
Wireless LAN Alliance (WLANA)
mack@wlana.com
www.wlana.com

A Snapshot of WLANA

- **Mission**
  - To foster industry growth through market education.
- **Approach**
  - Provide a clearinghouse of vendor-neutral information.
- **Audience**
  - Current and future customers, industry press and analysts, ISVs
- **Specific activities**
  - Compile / create educational documents
  - Sponsor industry studies
  - Actively work with industry press and analysts
  - Maintain educational web site: *www.wlana.com*

2

WLANA Members

- **3Com Corporation**
- **Aironet**
- **Bay Networks**
- **BreezeCOM**
- **Cabletron**
- **Harris Semiconductor**
- **Intermec Technologies, Inc.**
- **Lucent Technologies**
- **Proxim, Inc.**
- **Raytheon Electronics**
- **Symbol Technologies, Inc.**

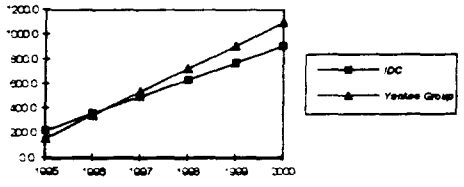
3

Wireless LAN Application Examples

- **Mainstream**
  - Data collection
  - Inventory management
  - Point-of-sale
- **Burgeoning**
  - Medical (ER Check-in, bedside computing, etc.)
  - Education
  - Campus computing
- **Emerging**
  - Project teams
  - Intranet access
  - Home

Wireless LAN Market Growth

- Over 100,000 customer installations today *(WLANA)*
- $300 million U.S. market today, expected to exceed $1 billion U.S. market by year 2000 *(Yankee Group)*



Results of recent wireless LAN study*

Wireless LANs:

- **improve worker productivity and service to customers**
- **provide *true* economic and business benefits**
- **are appreciated for their flexibility, ease of installation and mobility.**
- **provide a perfect complement to wired LAN infrastructures**

*** reference WLANA web site, www.wlana.com, for 8-page Executive Summary of study.**

Summary

- Wireless LAN industry is strong and growing
- Wireless LANs reduce costs, improve productivity and improve service
- Wireless LAN applications are broadening
- WLANA urges FCC to consider impact of Part 18 rule changes on the wireless LAN industry

The Wireless LAN Alliance

WLANA Contact Information

Mack Sullivan, Director
Wireless LAN Alliance (WLANA)
2723 Delaware Ave.
Redwood City, CA 94061

- Tel: 650-599-9260
- Fax: 650-366-4218
- Email: mack@wlana.com
- Web site: www.wlana.com

Wireless LAN Success Stories

MAY 1997

www.wlana.com

Contents

RESTAURANT AND RETAIL	*1*	Applebee's
	2	Honeybaked Ham Company
	3	T.G.I. Friday's
MANUFACTURING	*1*	Bayer
	2	Ford
	3	Ingram Micro
	4	Kraft
	5	Matsushita
	6	Mitsubishi Caterpillar Forklift America
	7	Ocean Spray
	8	Orbit Irrigation Products
	9	Paper Converting Plant
UTILITIES	*1*	Hydro Mississauga
EDUCATION AND RESEARCH	*1*	Carnegie Mellon University

WLANA
Wireless LAN Alliance

Introduction

WLANA MEMBERS

3Com Corporation

Advanced Micro Devices

Aironet

Andrew Corporation

BreezeCOM

Digital Equipment Corporation

Harris Semiconductor

IBM Corporation

Intermec Corporation

Lucent Technologies

Netwave Technologies, Inc.

Norand Corporation

Proxim, Inc.

Raytheon Electronics

Symbol Technologies

About These Stories

Welcome to the exciting world of wireless local area networking. The stories in this booklet describe real-life examples of successful wireless LAN applications. Today, wireless LANs are becoming commonplace across a broad range of industries and in a wide assortment of applications, from managing warehouse inventory to managing patient records. As the stories show, the mobility that wireless LANs offer lends companies and organizations measurable benefits—from higher employee productivity to lower operating costs.

For additional wireless LAN information, we invite you to visit the Wireless LAN Alliance Web site at www.wlana.com, where you will find a list of the leading companies in the wireless LAN industry and links to their Web sites. Also on WLANA's site are several resource guides with additional information on the rapidly emerging industry of wireless local area networking.

About the Wireless LAN Alliance (WLANA)

WLANA is a consortium of wireless LAN vendors formed to provide ongoing education about current applications of wireless local area networks and the future of the technology. WLANA is committed to establishing the wireless LAN as a key component of local area networking. To that end, members provide a clearinghouse of information on specific applications, current technologies, and the future capabilities of wireless LANs.

AMERICAN RED CROSS DISASTER SERVICE

Wireless LAN Helps Relief Agency Prepare for Disaster

The American Red Cross Disaster Service has more than 2,000 domestic chapters. Each maintains a supply warehouse and relief materials for state and local disasters. Now the Red Cross is testing a system of wireless, pen-based notebook PCs that will help Red Cross staff and volunteers get those supplies and materials where they're needed, when they're needed.

APPLICATION

Rapid Deployment of Temporary LANs

When disaster strikes, the American Red Cross Disaster Service operates like a huge mobile warehouse, setting up—on a moment's notice—locations for receiving and storing thousands of pallets of food, supplies, and equipment, and efficiently distributing those supplies to disaster victims. (Throughout each operation, a Red Cross central logistics database at the local disaster operational headquarters provides current inventory of all relief materials on hand.) These operations often take place under extreme conditions that cause logistical difficulties: heavy storms, power and telephone outages, continuing floods. Staff and volunteers must set up field houses for relief operations swiftly and often must move them during the course of an operation. When they have met relief needs, they must shut down field houses quickly and make equipment ready for immediate deployment at a new disaster site.

Richard Hoffman, senior systems programmer with the American Red Cross National Headquarters, said recent disasters demonstrated the need to replace the agency's paper-based inventory system with a high-capacity, automated system. Primary requirements for the system were mobility, reliability, an interface that would make the system easy for staff and volunteer workers to use, and hardware that would allow six to eight hours of continuous battery operation in the event of a power failure. Secondary requirements (to meet IRS requirements) included tight tracking of accounting records and of the materials and donated goods used during an operation.

Now the Red Cross is testing a system of hand-held wireless notebook PCs for use by staff and volunteers. Because much of the data collection during disasters is carried out by quickly trained volunteers with varying degrees of computer experience, the system has a simple, pen-based interface.

The wireless system tracks everything from perishables and water to equipment such as fax machines, cellular phones, and tables and

chairs. The system also maintains warehouse data and transmits the information to the central logistics database.

BENEFITS

Flexibility and Easy Setup

The Red Cross's wireless system provides mobile communication across large areas, through walls, and over high stacks of relief supplies. In addition, the hand-held units can operate in batch mode, which allows them to store information while they're temporarily out of range of the central database and eliminates the need to cover every square inch of a field house with radio frequency.

The system is quick and easy to set up; as Hoffman says, "Adding a notebook to the network is a fairly simple matter. And making future upgrades will be inexpensive and easy."

The Red Cross has already evaluated the system's inventory control and management capabilities at its national supply warehouse in Lorton, Virginia, and Hoffman says that "we'll try out the system in the field when the next disaster strikes." Sometime after that, the Red Cross will begin a five-warehouse rollout. If those installations prove successful, the Red Cross will make the software available to all local American Red Cross chapters.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

Health Care

WLANA
Wireless LAN Alliance

AUSTIN REGIONAL CLINIC
AUSTIN, TEXAS

Wirelessly Linked Computers Speed Billing at Medical Clinics

Medical clinics are fast becoming the leading alternative to hospital-based treatment. Austin Regional Clinic is a collection of multispecialty clinics in Austin, Texas, employing 130 medical professionals who treat hundreds of patients a day. Its new wireless LAN easily handles the increasing patient load, and it speeds insurance billing.

APPLICATION

Transmitting Patient Service Information Directly to a Billing System

The billing system at Austin Regional's clinics used to be based on volumes of paper notes on treatments and services rendered to patients. Each doctor's notes had to be transcribed, checked, and corrected before being passed on to insurance companies as bills for service. The paper system was expensive, and it prevented bills from being issued until at least two weeks from the date of treatment.

To minimize the paperwork and its associated costs and to reduce the delay in billing, Austin Regional decided in 1994 to automate its billing process. It gave medical professionals at 11 of its 19 clinics pen-based, hand-held computers that would accept patient service information and transmit it to the central billing system. To link the computers to each clinic's central server, Austin Regional installed wireless LAN adapters on computers in each clinic's existing wired network.

Now medical professionals at Austin Regional can record office visits, lab work, X-rays, and other treatments and submit billing information on the spot. The wireless LAN uploads the information directly to the clinic's server; in turn, the hard-wired LAN transfers the information to the corporate database. Bills are issued within 24 hours of a patient's visit.

Austin Regional's wireless system is now in place at 12 of its 19 clinics, where more than 250 wireless adapters have been installed in both mobile computers and stationary PCs. Plans are under way to expand the system to the remaining clinics.

BENEFITS

Faster Billing, Lower Installation and Maintenance Costs, Better Work Flow

The wireless installation's primary benefit is that it lets the clinics recover costs more quickly, but it also "saves the costs of pulling cable and maintaining a cable-based network," says Audrey Nudd, chief information officer at Austin Regional. Plus, it gives medical professionals the freedom they need to walk from room to room while still retaining full access to the server.

Furthermore, says Nudd, "eliminating massive amounts of paper has not only reduced paper handling costs, it has cut down on transcription errors, which in turn has improved work flow."

Nudd calculates that each clinic will fully recover the cost of installing its system only 1.2 years after the date of installation. Even more important, the wireless system gives medical professionals at the clinics a tool that is quick and easy to use.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

MERCY MEDICAL CENTER
SPRINGFIELD, OHIO

Wireless Technology Raises Hospital's Efficiency and Quality of Care

Wireless LAN technology is helping this hospital reach its goals of treating patients quickly and efficiently while providing high-quality care and keeping accurate records.

APPLICATIONS

Mobile Case Management, Cost Calculating, and Admissions

Mercy's case managers gather insurer authorizations for procedures to be performed on patients and for the length of patients' stays at the medical center. Formerly, that process required two steps: gathering information and entering it in the hospital information system, or HIS.

Once it had installed a wireless LAN, Mercy could consolidate those two steps into one. Now, using portable wireless workstations—20 in all, supported by six host computers—case managers enter information into the HIS as they gather it, without traveling to wired workstations or plugging into ports.

Case managers also monitor the quality of infection control, risk management, and general care for each patient. Each domain once constituted a separate department, and department coordinators would routinely review the charts of patients considered at high risk in their respective domains. After installing its wireless LAN, Mercy redesigned the process: Now case managers screen the charts for all areas and enter that information in the hospital's managed care system; the appropriate coordinator receives information on a particular patient only if follow-up is needed.

Mercy cost calculating staff translate diagnostic and care procedures recorded on patients' charts to a standard code that insurers use to figure reimbursement. Coding used to take place only after patients left the hospital, which meant that Mercy could calculate the cost of care only after providing care.

Now, using mobile workstations, coding staff can gather information from charts still in circulation and communicate with physicians while their patients are still in the hospital. The result: Coders have a complete, accurate listing of each patient's diagnosis as soon as the patient is discharged. And because coders can now make diagnosis statements

available for doctors to sign at discharge, they don't have to wait for doctors to sign statements later; they can bill patients immediately.

Mercy is in the process of exploring ways to use its wireless system to admit patients more quickly. Admissions clerks use wireless workstations to admit emergency room patients who are moving to the main hospital, and to admit children after they have arrived in pediatrics. Admissions nurses use wireless workstations to plan and order procedures from patients' bedsides.

BENEFITS

Contained Costs, Faster Cost Calculating and Admissions, and Better Care

Making its work force mobile has transformed Mercy's overall efficiency. Now that case managers record insurance information directly, hospital staff have access to the information they need in real time, which helps Mercy both contain costs and raise the quality of care. And because case managers can use their workstations throughout the areas of the hospital that they cover, Mercy avoids the cost and space constraints of maintaining a separate workstation for a case manager in each area.

Now that cost calculating doesn't have to wait until after a patient leaves, Mercy "can establish the cost of a patient's care much more quickly," says Therese Riehle, Mercy's director of care coordination. It's a much more efficient and accurate process than before. Finally, by giving Mercy "the ability to take the admitting process to the patient," wireless technology helps speed care giving and improve the quality of care even further.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

NORTHWEST HEALTH CENTER
CHICAGO, ILLINOIS

Greater Profits *and* More Comprehensive Care at a Small Clinic

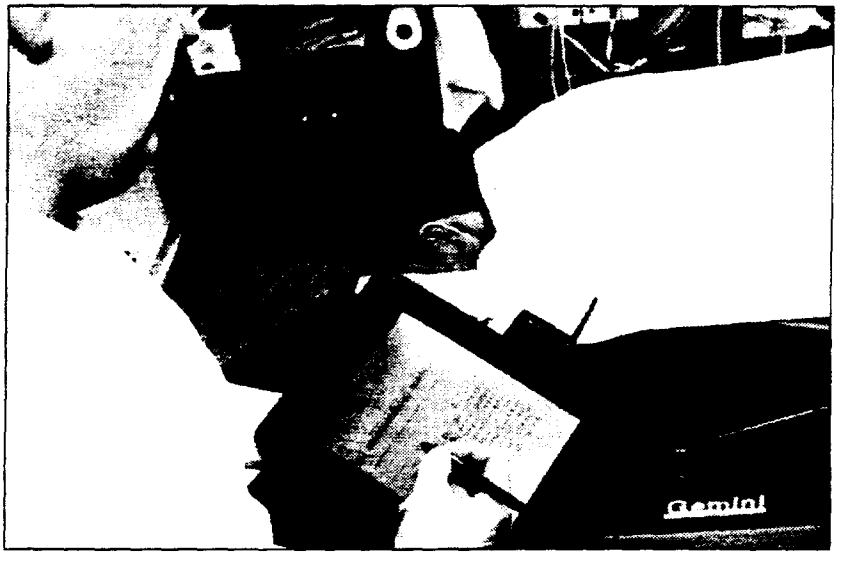
The challenge to do more with less is driving primary providers to look for more efficient ways to run their practices. As administrative burdens rise and reimbursement rates decline, providers are all asking the same questions: How can they lower operating expenses, increase the number of patient visits, and make care faster and more convenient? And how can they accomplish those objectives with a rapid financial return on investment and little or no added system support? Northwest Health Center, a small naprapathic and chiropractic clinic in Chicago, found the answers in wireless technology.

APPLICATION

Giving Doctors Mobile Access to the Clinic's Wired Network

Northwest Health Center's two doctors see patients in six treating rooms. As they go from patient to patient, they record S.O.A.P. (subjective, objective, assessment, plan) notes.

Before Northwest installed its wireless LAN, doctors had access to patient records only through the PCs in its front office. Now, with wireless-adapted, pen-based mobile computers (linked to the wired network



through two access points) and commercially available S.O.A.P. software, not only can Northwest's partners access patient records from any room in the office, they can enter notes on the spot, as they provide care. Setting up the wireless LAN and connecting it to the existing Ethernet network was easy: The partners did it themselves in about two hours.

BENEFITS

Lower Costs, a Faster Process, More Complete Care, and a Flexible Network

Says Northwest Health Center partner Richard Warren, D.N., "We wanted to improve the speed and convenience of doing our job—and we did. I would absolutely recommend that other practices do this. The combination of the wireless LAN and S.O.A.P. software speeds up the process of providing care and allows us to see more patients—I'd say we're seeing three to four more patients per day."

Consolidating documentation and care into one step has been a huge benefit. Because doctors at Northwest Health now have mobile access to patient records as they go from room to room providing treatment, they never have to go back to a computer on the wired network, and no one has to transcribe or dictate notes for entry into a computer in the front office. By freeing the documentation process from paper and desktop computers, the wireless system eliminated the need for at least one part-time employee at the front desk dedicated to transcription. That saved at least $10,000 to $12,000 a year and made the system pay for itself in less than a year. An additional benefit of the notes generated through the S.O.A.P. software is better documentation for insurance billing and letters to attorneys in legal cases.

The wireless network also gives doctors access to information that they otherwise would not have access to while with a patient. And, because the network gives doctors access to all of the network's services, such as printing, "we can print a patient note or schedule an appointment and send that information wirelessly to our front office," says Warren. "We can even access a patient's record, enter a treatment plan, and enter the financial transaction directly. The information goes right into the hard drive on our file server, which is backed up every night."

Accommodating any new doctor who joins the practice will be a snap. Since the wireless backbone is already in place, expanding the network will be as easy as buying another mobile computer and wireless adapter.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

WLANA
Wireless LAN Alliance

SAINT JOSEPH HOSPITAL
DENVER, COLORADO

Wireless LAN Helps Hospital Meet Managed Health Care Challenge

Managed health care is based on predefined fees for medical procedures, but those predefined amounts often are lower than the amounts that hospitals otherwise would charge to cover costs. Denver-based Saint Joseph Hospital, founded more than 100 years ago, is recognized for excellent care at very competitive rates. Wireless technology is helping it to manage the costs of patient visits and procedures more closely while continuing to deliver superior care.

APPLICATION

Access to Patient Records and Medical Reference

In 1995, the information services group at Saint Joseph took a look at what emerging information technologies could do to help the hospital maintain its strong competitive position. Saint Joseph's plan was to put access to information—both patient records and the hospital's medical reference library—closer to the point of care. Doing so would allow the hospital to analyze and manage patient information more closely and concurrently, and control the costs of patient visits and treatment.

"Our goal was to choreograph a patient's stay, detailing exactly what needed to happen and when. We saw that one of the most effective ways to ensure that everything happened according to plan would be to give nurses access to patient records directly from a patient's bedside," said Douglas Hahn, Manager of Information Services at Saint Joseph. "We knew we could provide the required care without excess costs by following a carefully defined process."

The hospital wanted nurses to be able to chart patient information from bedside. The information services group already planned to replace the existing mainframe-based network with interconnected Ethernet LANs, so it considered extending the hard-wired network to each room in the 600-bed hospital. However, Hahn quickly recognized major disadvantages in that plan.

First, the cost of installing cable and purchasing PCs for every room would be prohibitive. Also, unintelligent terminals would not provide the computing power that nurses would need to run applications or access patient records stored on CD-ROM. Furthermore, in pilot tests, patients found the fan noise from the computers annoying. Because the building was not new, laying cable would be difficult, and in many hospital rooms there simply wasn't enough space for a computer. Finally, Hahn feared that PCs installed in hospital rooms would be exposed to tampering, which could result in damage either to the equipment itself or to the security of the information on the network.

The hospital overcame all of those obstacles by using wireless LAN technology instead of extending the wired network to every room.

Before the hospital installed the wireless system, nurses took notes on patient information and later entered the information on a patient's paper chart. Now a specially designed cart carries nurses' supplies, such as alcohol swabs and I.V. caps, as well as a laptop computer with a wireless LAN adapter. Nurses take the carts with them from room to room, using the laptops to enter information or access patient records. Nurses can enter patient information on the spot, and a clinical application on the network makes the information easy to chart.

When a patient arrives, the hospital maps out every aspect of the patient's stay—what treatments the patient should receive, and how long the patient should stay in various departments—according to the managed care prescription for the procedure in question. Nurses use their access to the up-to-date information on the network to make sure that each patient is treated according to plan.

"Although people often resist new technology, we were able to make it easy for the nurses to use the new applications and the wireless units, so the new system isn't a burden to them. It has been very successful," says Hahn.

Saint Joseph now has 70 carts with notebook computers on the wireless LAN. Ten access points connect the LAN to the hospital's Ethernet network.

BENEFITS

Minimized Installation and Maintenance Costs, Streamlined Procedures, Better Security

The most obvious benefit of the wireless system was its cost: By installing a wireless LAN, Saint Joseph avoided purchasing, installing, networking, and maintaining a huge number of PCs. However, the wireless LAN's advantages go far beyond equipment savings. Entering information directly into the network eliminates the step of reentering handwritten information into a central terminal and reduces the chance of transcription errors. In addition, because nurses take their laptops with them wherever they go in the hospital, the equipment and the network are secure.

Hahn said Saint Joseph plans to expand its use of wireless technology. "We are looking at providing other groups in the hospital with wireless capabilities. Physical therapists, for example, often go from room to room or floor to floor, and it's inconvenient for them to use a stationary PC. With wireless units, they'll be able to access and update patient records or other information from anywhere in the building." Another advantageous use of wireless technology that the hospital is considering: By linking surgery rooms wirelessly to the hospital network, Saint Joseph can avoid both the risk of contaminating the rooms and the need to shut them down while cable and other hardware are installed.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

SARASOTA MEMORIAL HOSPITAL
SARASOTA, FLORIDA

Wireless Admissions Process Makes Patients Feel Better

Arriving for a hospital stay can be a difficult experience, but Sarasota Memorial Hospital in Sarasota, Florida, has made admissions much easier on incoming patients. Patients used to wait in the hospital's lobby until admissions reps were ready to process their paperwork. Now, because of a new wireless LAN, patients go right to their rooms, and admissions reps admit them there.

APPLICATION

Making the Hospital Admissions Process Portable

Tom Murphy, Sarasota's supervisor of network services, says that the hospital decided to look at admitting as a process rather than as a department or piece of first-floor real estate (which is at a premium in any health care institution). With that inspiration, Sarasota began a pilot wireless admissions program, which was so successful that the hospital ended up dissolving its admissions department and redesigning its lobby.

Now all patients (except outpatients, who check in at one of six stations in the lobby) are greeted at the door and assigned a room immediately. There they can make telephone calls, watch television, and relax while waiting for an admissions rep to arrive. The reps process admissions using notebook PCs equipped with wireless LAN cards. Through wireless access points strategically positioned on selected floors of the hospital (each covering 150- to 200-foot areas through walls, ceilings, and floors), reps have uninterrupted, interactive access to data on the LAN from anywhere in the hospital.

BENEFITS

Prompter Care, More Comfortable Patients—and Better Staff Services

With the wireless LAN, each patient has one less stop to make. That means that Sarasota can make patients more comfortable while it speeds up admissions, and admissions reps are finding their jobs easier now that they're dealing with much more relaxed patients. Another plus: In the event of a disaster, triage teams can meet ambulances in the driveway and use the wireless system to begin admissions immediately.

But the benefits of Sarasota's streamlined admission process extend well beyond admitting patients. "Because patients are getting where

they need to be on time, the wireless LAN also helps keep the nursing unit and areas like surgery and radiology on schedule," says Jeff Williamson, director of admissions before the change and now a project consultant.

And with the wireless LAN now accessible from most parts of the hospital, nurses can now track patient room changes and enter orders for lab work and patient services from portable PCs rather than terminals. A conference room has become an instant classroom. A hard-to-wire auditorium is now equipped with PC demo facilities. And mobile workers, such as network services staff, can now access the network from other facilities.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

Trading and Banking

CENTURA BANK
NORTH CAROLINA

Wireless LAN a Good Investment at This Bank

Centura Bank is the seventh largest bank in North Carolina, with over $4.2 billion in assets. Like most banks, Centura relies on its networking systems to serve customers quickly and efficiently. Now its new wireless networks are helping Centura push the envelope in banking services.

APPLICATION

Expanding Branch Office Networks

In the early 1990s, Centura made plans to expand automated banking options and increase branch employees' decision making authority over loans, service pricing, and interest rates. But carrying out those plans meant expanding the networks at each of Centura's 150-plus branch offices and connecting the networks to mainframes at bank headquarters. Initial estimates for recabling alone stood at $750,000; it would have cost another $200,000 each year to reorganize the workstations at all the branches.

Instead of rewiring each branch office, Centura judged installing wireless LANs the most cost-effective solution. Now Centura's 150 branches, each with an average of about 10 workstations, use their wireless LANs to perform a variety of tasks, including running new financial applications and accessing information at headquarters.

BENEFITS

Lower Operating Costs, Maximum Flexibility, Better Customer Service —All without Wiring

Because a wireless LAN costs relatively little to install and maintain, Centura saved most of the three quarters of a million dollars it would have spent on cabling, and it completely avoided the annual cost of moving workstations around in branch offices. Centura's after-tax return on investment was 30 percent higher than if it had expanded its existing wired networks.

Wireless and wired LANs achieve virtually identical performance under normal conditions, yet wireless LANs make it much easier to allocate network resources. "A wireless network naturally decreases the

costs of moving and of making additions and changes in the office," says Centura's Paul Davis. "It's nothing when someone wants to relocate a workstation within a facility—you just move the workstation into another area, plug it in, and keep going." That flexibility helps Centura expand banking options and give customers better, faster, and more responsive service.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

HULL TRADING
CHICAGO, ILLINOIS

Taking the Lead in Wireless Stock and Option Trading

International trading company Hull Trading actively participates in several thousand contracts per day on floors including the American Stock Exchange, the New York Stock Exchange, and international derivative exchanges in Frankfurt and Hong Kong. It's one of the most innovative companies of its kind, implementing a wireless LAN system as early as 1992 and leading wireless network implementation at the Chicago Board Options Exchange.

APPLICATION

Real-Time Information and Transactions on the Exchange Floor

For some time, trading company clerks have had communications access to their home offices through a wired network. However, many still use color-coded screens and hand signals to communicate pricing information from their booths above the exchange floor to traders on the floor, or they deliver price sheets to the traders via runners. Several years ago, Hull Trading recognized that the old system—a manual, multipart process—didn't bring information to traders in an effective or timely way. Says Warren Langley, a principal at Hull, "We had to find a way to put networked PC capabilities into the hands of our traders."

As part of its strategy of constantly evaluating technologies that provide the maximum competitive advantage for its traders, Hull installed a pilot wireless LAN system at the Chicago Board Options Exchange several years ago. Now, using a hand-held PC with a wireless LAN adapter, every Hull trader on the Chicago Board can get pricing information from Hull's database in real time—and record each transaction as it happens.

Twenty of Hull's Chicago Board traders use hand-held computers with fully integrated wireless LAN adapters; they share about 30 access points, which link them to the server on Hull Trading's wired network, with several other trading companies (use of the access points is governed by a users' group and the Exchange). The latest upgrade, installed in 1995, transmits data at a fast 1.6 megabits per second.

BENEFITS

Better Information, Better Traders; a Boost for the Whole Market

The wireless LAN lets Hull provide its traders with real-time bids, offers, and other proprietary information. By reducing the amount of time it takes to deliver the information that traders need, the wireless system enhances the skills and talents of Hull's traders: It lets the company make the highest quality trades for brokers and their investor clients. "Wireless was the final link we needed between our computer systems here and the individual trader on the floor," says Hull's Langley. "It's a key capability for Hull Trading."

Hull's use of wireless technology is good for the entire trading market, too. "The use of wireless technology in this market is a very positive development," says Langley. Hull has gone before exchange committees to demonstrate that the technology benefits customers by enabling traders to get better prices and more depth in the market. Now that most of the major exchanges are working on their own internal wireless systems for auditing and tracking trades, Hull—as one of the pioneers in using wireless technology in the trading market—can help develop optimum systems.

Finally, Hull's choice of a system that allows 15 independent wireless LANs to operate in the same physical space offers dual advantages: Hull can expand its system significantly, and other trading companies can also operate their systems alongside Hull's.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

NEW YORK STOCK EXCHANGE AND AMERICAN STOCK EXCHANGE

Wireless Trading Catches Up with Stock and Option Traders

Stock and option trading is a venerable institution—some stock exchanges are centuries old, as is the practice of writing option contracts. Today, while trading's importance to the world economy is monumental, traders still make transactions by shouting, waving, and scribbling notes on slips of paper. At the NYSE and the AMEX, the shouting and waving may go on, but these exchanges will soon trade paper notes for the speed and reliability of wireless networks.

APPLICATION

Tracking and Facilitating Transactions on the Exchange Floor

The wireless networks at the NYSE and the AMEX will extend networking technology into places where no network was possible before. Both the NYSE and the AMEX already have phone and wired computer networks that allow clerks in the booths above the exchange floor to communicate with the outside, say a brokerage's main office. When orders reach the clerks, however, they reach the end of the wired road. The clerks write each order on a ticket, which a runner then takes to the appropriate broker on the floor. Once the broker makes the transaction—either through another broker ready to buy or sell or through a "market maker"—he or she records the transaction and gives the receipt to a runner; the runner brings it to a clerk, and the clerk enters the transaction information on a computer for relay back to the main office or transaction clearing partner.

Now the NYSE and the AMEX are developing a wireless backbone that will replace the runners and paper tickets between the clerks and the brokers with hand-held wireless computers. Both systems will be available for use by any member firm. When the NYSE infrastructure is complete, any member firm will be able to use it to transmit information directly between their clerks in the booths and the traders on the floor. Says Robert Britz, NYSE group executive vice president, equities, "The system will complete the loop of technological enhancement that the NYSE has been implementing over the past two years." AMEX rules will allow direct wireless communication between traders and their brokerages or clearing partners outside the exchange. In both exchanges, transactions will be recorded as they happen, speeding up the entire trading process and paving the way for an array of benefits to firms, their clients, and the exchanges.

The NYSE put its first broker on-line at the end of 1996 and has scheduled its wireless system for full rollout in the second half of 1997. The system will ultimately help bring more than 1,300 traders and NYSE

staff members on-line by providing them with hand-held computers equipped with wireless cards that connect them to the wired network.

The AMEX is installing access points; this wireless infrastructure will serve 200 AMEX personnel and 1,000 individual firms and traders, who will supply their own hand-held computers and wireless cards.

BENEFITS

Speedier, Better Information Both to and from the Floor

The wireless networks at the NYSE and the AMEX will give brokers instant access to proprietary information. Instant number-crunching power will be another important benefit: On their hand-held computers, traders can even run proprietary algorithms and run what-if scenarios right on the floor—a crucial advantage in the volatile world of option trading, where traders make huge buying and selling decisions on price shifts of mere pennies and timing is even more crucial than in securities trading.

And with transactions entering the system instantly, brokers and traders will be able to make better decisions. Under the old system, analyticals (the information on share prices and underlying variables that indicates the price levels at which options should trade) were manually updated, a process that took 24 hours or more. With the new system, option traders will always have up-to-the-minute analyticals at their fingertips.

Other benefits of the wireless network include the reliability and accountability it will lend to transactions. Because transactions are made and recorded all in one step, they won't get lost. And because every step of every transaction takes place electronically, auditors will be able to follow an audit trail through the network for any transaction at any time. Thus the wireless networks will allow the exchanges to implement a level of oversight that wasn't possible before.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

Consulting and Sales

DELOITTE & TOUCHE/ICS
NEW ZEALAND

Consulting Teams Using Wireless LANs Increase Productivity

Deloitte & Touche Consulting Group/ICS is one of the world's top consulting firms. To build on the company's reputation and continue its leadership in providing high-quality consulting services, the New Zealand group has begun using wireless LAN technology to further improve its consulting teams' efficiency and productivity.

APPLICATION

Providing Mobile Network Access in Office and Consulting Environments

The New Zealand group of Deloitte & Touche/ICS provides rapid SAP implementation services for the entire Australia and New Zealand region. (SAP is a German company that specializes in standardizing applications used across platforms.) Consultants there are using wireless LANs in the office to extend the company's wired network. For instance, they often use a wireless LAN to copy PowerPoint presentations from the server to their laptops before leaving the office to visit client sites.

Because the New Zealand office is connected to the Australia office of Deloitte & Touche/ICS by frame relay, consultants can also use a wireless LAN to connect their laptops to the systems in Australia. Other common applications that consultants run through the wireless LAN include Netscape Navigator, cc:Mail, and Microsoft Schedule. Wireless LANs give consultants access to the network and to their work any time, from anywhere within the office.

"We use the wireless LAN for just about everything," said Martyn Halsall, Director of Consulting, adding that "cc:Mail is our main communication channel. We rely on the wireless LAN to maintain regular contact with our people."

The New Zealand group has been so pleased with the results of using wireless LANs in house that it has extended wireless LAN use to client sites. Consultants may spend a few days or months at a time at a client site; with a wireless LAN, they can establish a wireless connection to the client's SAP server in minutes, from anywhere in the client's office, and get to work quickly. Consultants can also use a wireless LAN to collaborate more easily in building a final report. Finally, because consultants don't have to actually plug their laptops into a wired network, it's easier for them to stop by the office and access the office network on the way to or from a client site.

The New Zealand office started with five access points and 45 laptops with wireless adapters. In the second phase of implementation, it will expand the network with three more access points and 30 more laptops.

BENEFITS

Mobility and Instantaneous Network Access

Wireless LANs make a clear improvement in efficiency, productivity, and service for Deloitte & Touche/ICS. In the New Zealand office, wireless LANs give consultants access to the information they need, no matter where they are—in their own offices or in conference rooms.

At client sites, too, wireless LANs keep consultants from being tethered to a particular wired network connection, letting them service more clients with more flexibility. Moreover, wireless LANs give consultants the benefit of instantaneous access to their clients' networks. Because several consultants at a time can use a wireless LAN to access a client's server, consultants spend less time looking for and setting up wired network connections and more time auditing and consulting.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

MICROSOFT
WESTERN REGIONAL OFFICE

Wireless LANs Minimize Equipment and Setup Time for Product Sales Demonstrations

Microsoft offers customers a wide variety of services and programs. One of those services is keeping customers up-to-date on Microsoft's leading-edge software solutions. Product demonstrations used to be cumbersome, but wireless networking is making them easy.

APPLICATION

Setting Up On-Site Product Demonstrations

When Microsoft was about to release Windows 95, many Fortune 1000 customers expected to adopt it, along with the corresponding upgrade for the Microsoft Office suite. They needed to know ahead of time what features the new operating system and applications would offer. To familiarize customers with the upgrades, Microsoft's systems engineers conducted numerous product demonstrations at customer sites in the months before the release. However, setting up the many pieces of equipment needed to stage such demonstrations was cumbersome and time consuming. For a 90-minute demonstration, setting up and tearing down network configurations using standard 10BaseT Ethernet hubs and cabling took about 45 minutes. As one engineer put it, "Setting up equipment is not an effective way of spending time at a customer site." The engineers needed a wireless networking solution that had reasonable range and would minimize setup but that would still be compatible with existing LANs.

One of Microsoft's regional offices, which serves four western states, decided to try out a radio-based wireless LAN system. The system consisted of two or more laptops, each configured with a wireless LAN adapter. Through an access point on a customer's site, the engineers could use the wireless LAN to demonstrate Windows 95 network services by accessing a local file server, printing documents, sending e-mail, or using the Internet.

BENEFITS

More Demonstrations in Less Time, at Lower Cost

Now that the engineers have no hubs and wires to run, setting up demonstrations is simple. The system's mobility, reliability, and ease of

use means that every engineer can conduct more demonstrations each week and has far less equipment to carry from site to site. It also results in lower equipment and transportation costs—a few laptops and wireless adapters are much easier to carry than an Ethernet hub and 30 to 40 feet of cable. Moreover, the system eliminates the need for access to AC power outlets.

"Wireless networking reduces setup time, allowing me to really focus on our software solutions," says Jeff Zalkind, a satisfied senior systems engineer at Microsoft's Denver regional headquarters.

The success of the wireless LAN system at the Denver regional office spurred sales engineers to implement similar networking solutions for customer demonstrations in 15 other Microsoft district offices.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

Restaurant and Retail

APPLEBEE'S

Wireless Order Entry Streamlines Restaurant Operations

A new wireless LAN order entry system gives national restaurant chain Applebee's a more streamlined and flexible way of doing business.

APPLICATION

Installing a Network in a Hard-to-Retrofit Environment

Before it installed a wireless LAN, Applebee's used a total of five different systems to report sales and labor data from its restaurant locations to headquarters, which made it hard for corporate management to track the information. Standardizing the Applebee's point-of-sale system would have meant retrofitting the networks at every restaurant, but it wouldn't have been easy to install a hard-wired network at the chain's more than 50 locations. Restaurant traffic flow and equipment (such as refrigeration units and open grills) would have made running cable a major challenge.

To avoid the disadvantages of hard-wired retrofitting, Applebee's chose wireless LANs to support its new chain-wide point-of-sale system. Now, after restaurant staff take orders from customers, they punch the orders into a computer with a touch-screen monitor. A wireless network then relays the orders from the dining room to the restaurant's in-house file server. The file server handles the tasks of sales consolidation and labor reporting to headquarters via modem, over a regular phone line.

The Applebee's system comprises 300 wireless LANs with nearly 2,000 workstations.

BENEFITS

Simpler Reporting and Less Costly, More Convenient Networking

The wireless LAN not only simplifies the reporting process and spares Applebee's the expense and inconveniences of cabling, as planned—it also lets restaurant managers put terminals anywhere they're needed. Says Applebee's manager John McDermott, "The wireless LAN gives us more flexibility. At any time I can unplug a workstation and move it to

another outlet anywhere else in the restaurant, and it's still on the network. If I wanted to do that with a hard-wired system, I'd actually have to run cables there."

Another unique benefit of a wireless LAN is the way it accommodates hand-held devices, which Applebee's plans to add to its system. Restaurant staff at Applebee's will be able to use the devices while taking orders, and managers will be able to use them to collect other information.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

HONEYBAKED HAM COMPANY
GEORGIA

Wireless LAN Connects Point-of-Sale Data to Headquarters

A retail chain that sells baked ham and other prepared foods, the Honeybaked Ham Company of Georgia has 94 retail stores across the country and opens about six new stores each year. In the early 1990s, like many other retailers, Honeybaked found itself overwhelmed with paperwork and eager to automate its record keeping. Wireless point-of-sale computers solved the problem.

APPLICATION

Automatic Retail Record Keeping

Until a few years ago, each Honeybaked Ham store used conventional cash registers. Store managers prepared paper reports of sales, expenses, and other information manually and mailed them to Honeybaked headquarters in Atlanta.

However, the reports took time to prepare and weren't always accurate, and company headquarters received so many of them that they could hardly keep up. Translating the reports into information that top management could use was also labor intensive and time consuming, and things got worse each year as more stores were opened.

By 1993, Honeybaked decided to replace the cash registers with wireless point-of-sale computers. "Our goal was to create a standard computer system that could be used in all our existing stores and that could be easily installed in new stores as they opened," says Stan Vick, director of information systems at Honeybaked Ham. The point-of-sale computers sit on carts, which normally are placed inside cutouts in the counters but can easily be pushed to other locations. The computers are networked to a local server that tracks store operations and generates reports, and an ISDN line connects all the local servers to a master server at company headquarters. Store reports are automatically uploaded to headquarters periodically under the direction of a robust network scheduling program, and plans are in the works to incorporate inventory control in the system.

A typical Honeybaked Ham store is equipped with about five computers, depending on the store's size and sales volume. Two computers serve as point-of-sale terminals. The store manager uses the third computer as a workstation, and a fourth acts as the store's local server. Employees use a fifth computer in the back of the store as a secondary point-of-sale terminal, primarily to handle large telephone orders from corporate customers.

BENEFITS

The Most Flexible Solution at the Lowest Cost, plus Better Business Information

"During holiday seasons, when our business peaks, most of our stores move the point-of-sale terminals from the counters to a location near the store's exit door," says Vick. "Some even build a simple enclosure and move the terminals just outside the door." And not only does the wireless system provide Honeybaked Ham with an ideally flexible solution, it costs less to install than wired networks.

The wireless system has slashed paperwork costs throughout the company, too. At the same time, it has revolutionized the reporting process: Top managers now get accurate, timely reports in a form that helps them make better business decisions.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

T.G.I. FRIDAY'S
TALLAHASSEE, FLORIDA

Wireless LAN Serves Restaurant Customers Better

Employees at large restaurants have to juggle plenty of constantly changing information—about what's going on at each table, the number of waiting customers, and so on—and still provide service with a smile. Their challenge is to minimize the time that customers spend waiting by maximizing the efficiency of the services they apply to each table. At T.G.I. Friday's, hosts and hostesses get a big boost from a wireless LAN.

APPLICATION

Managing Restaurant Seating

T.G.I. Friday's employees must keep continuous running lists of waiting customers, the size of each party, seating preferences, table availability, orders, the activity at each table, service requests, and bill payment—at 40 to 80 tables mostly filled by random patron walk-ins. To avoid keeping patrons waiting for service, the employees use table management software that coordinates information from various locations in the restaurant—for example, the host or hostess's station, the service bay, the busing station, and the tables themselves.

At T.G.I. Friday's restaurants, those locations are linked to a touch-screen computer in a kiosk at the host or hostess's station through a hard-wired local area network. According to Tony Laudadio, manager at

T.G.I. Friday's in Tallahassee, Florida, "When a guest comes in the door, the host or hostess takes their name and either calls it up on the reservation list or enters it into the system. The name is transmitted to the

main terminal, which keeps track of the dining room and lets us know what tables are available and the capacity of each one. When a table of the appropriate size becomes available, the guest's name is automatically highlighted and the host or hostess walks the party to their seats."

With only one kiosk at the host or hostess's station, it's easy for the station to become a bottleneck at lunch and dinner. The lines that form mean that tables sit empty while customers wait. So when T.G.I. Friday's opened a new restaurant in Tallahassee, it added a hand-held, pen-based wireless tablet to the wired LAN. A second host or hostess uses the tablet in addition to the computer used at the stationary kiosk. A single access point links the tablet's wireless LAN adapter to the wired network throughout the 80-table restaurant.

BENEFITS

Less Expensive, Better Network Access That Doubles Efficiency

Because the wireless tablet gives the second host or hostess the same access to the main terminal's restaurant-wide information as the stationary kiosk, up to twice as many customers can be seated at a time. Plus, because the tablet can transmit and receive data from anywhere in the restaurant, a host or hostess has the freedom to access the main terminal from the patio or other spot where customers may be waiting and then walk them straight to their seats. The wireless addition to the network cuts the restaurant's bottleneck during peak times in half.

"The guests are as enthusiastic about it as we are," says Laudadio. "It dramatically reduces the amount of time that a table sits vacant. That benefits our guests because they spend less time waiting. It's beneficial to us because we can turn tables more quickly and increase sales as a result."

The wireless tablet is not only easier to use than the stationary kiosk, it also was less expensive and much easier to install. Wireless technology spared T.G.I. Friday's the costs of building and installing another bulky kiosk at the entrance.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

Manufacturing

BAYER
CANADIAN WAREHOUSES

Wireless System Keeps Vast Inventory on Track

Bayer, Inc. (formerly Miles Canada, Inc., and belonging to parent company Bayer AG of Germany), sells more than 25,000 different stock keeping units, or SKUs, to businesses ranging from local drug stores to the Big Three U.S. auto makers. Bayer stays competitive and handles an influx of new products thanks to a wireless system it installed in 1995.

APPLICATION

Real-Time Data Collection and Inventory Management

In the early 1990s, Bayer consolidated four of its companies into one. At the same time, its products multiplied and its customer bases (in health care, chemicals, and imaging technologies) ballooned. Some 55 Bayer employees in Canada (operating warehouses totaling 185,000 square feet with dozens of loading docks) had more product to inventory than the batch processing system could handle. High volume and the potential for human error were resulting in too many mistakes.

To design an ideal warehouse management system, Bayer organized a 10-person steering committee of warehouse managers and operators. Says Harold Mueller, Bayer's director of logistics, "First on our list was a real-time database transmission system to save money, reduce person hours, cut down on paperwork and improve employee efficiency. Our tremendous volume of diverse products required it. A batch system isn't updated in real time, and it makes taking accurate inventory difficult."

After analyzing the types of product stored and determining the number of base stations required to cover the employees in each warehouse, Bayer chose two systems. For three of the warehouses, it chose 46 hand-held computers with laser scanners, keypads, and bar code readers, all wirelessly linked to a printer and scanners. For a fourth warehouse, where hazardous materials are stored, Bayer chose impact-resistant computers. Both systems are wirelessly linked to an IBM AS/400 minicomputer, and both have a modular design that makes upgrades easy.

BENEFITS

Dramatic Improvements in Distribution, Tracking, and Quality Control

Using the wireless system, a warehouse operator in Bayer's Canadian warehouses can process an individual order in less than 30 seconds. The warehouses now ship 24,000 orders per month with shipping and inventory accuracies of over 99 percent—and virtually no complaints. Most distribution is paperless: Through an EDI link (an on-line shipping, tracking, and payment system), Bayer advises its carriers of shipments and payments without waiting to receive and pay invoices. The system automatically routes and checks in products for destination, weight, and class. Warehouse operators can find out what's available at any instant, and instead of being a separate job, inventory counting is part of every operator's routine. What's more, now employees know that inventory is accurate.

Tracking has become vastly more efficient now that Bayer service staff can now get instant information on the status of a customer order. And as for quality control, products are quarantined as soon as employees report any damage. According to Mueller, the risk of sending out damaged products has been virtually eliminated.

With such high volume and so many products, the wireless system's real-time transmission capabilities have become an essential asset to Bayer's business.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

FORD
LOUISVILLE, KENTUCKY

Wireless LANs Improve Quality and Efficiency at Truck Plant

Henry Ford's Model T—state of the art in its day—changed the way products were manufactured around the world. Ford's new advanced wireless tracking system builds on the company's reputation for innovative automation technology.

APPLICATIONS

Quality Control Monitoring, Materials Tracking, and Inventory Management

Ford's Kentucky Truck Plant in Louisville is over 4 million square feet in size and produces over 200,000 trucks annually, each a composite of thousands of parts. The plant operates on the world's largest wireless quality control monitoring, product tracking, and inventory management system. Quality control inspectors, forklift operators and clerks, and shipping staff use wireless, pen-based portable teletransaction computers, or PTCs, throughout the manufacturing process.

Before the wireless system was installed, quality inspectors noted defects on forms, and repair people initialed the forms when the repairs were finished. However, errors took hours or sometimes even days to identify and correct, so inspectors often didn't find out about problems with a truck until well after the problems had originated.

Ford wanted to keep quality control as simple as possible, so the new system had to involve minimal data entry. In fact, it ended up making the process even simpler. Now, after entering a personal access code into a PTC at the start of a shift, each inspector makes choices from a series of lists displayed on the screen, without writing down anything at all. And all information entered on the PTCs, which can be used anywhere in the manufacturing complex, is transmitted instantly to a central mainframe computer.

At the start of the manufacturing process, each manufactured unit is assigned a serial number. As a unit enters an area of the plant, the inspector's PTC lists the options pertinent to that area and shows which options were ordered for that particular truck. The inspector enters the inspection results for each option—defect or no—on the PTC. Farther on down the assembly line, in the same area of the plant, a quality upgrader's PTC displays the defects to be corrected. The system effectively prevents a unit from being sent on to the next area until the upgrader notes that all defects have been repaired.

Ford also applied the wireless LAN to materials tracking: The system tracks every component and box of material that enters the facility to its consumption point on the assembly line.

The wireless LAN even extends outdoors to the ship-out yard—which often holds more than 1,000 trucks—where PTCs are used for tracking finished product inventory. The wireless system not only tracks every truck's location in the yard, it tells the shipping staff why the truck is there: whether it's scheduled for an engineering change, whether it's due to a third party for aftermarket work or body work, or whether a finance issue must be resolved before a truck can be shipped out.

The Kentucky Truck Plant's wireless LAN installation started out serving about 300 plant inspectors and other workers. Now the number of users has gone up to 450; two completely redundant wireless networks with a total of 160 access points and antennas guard against downtime. Ford is in the process of implementing wireless LANs at other manufacturing plants and distribution centers worldwide.

BENEFITS

More Competitive Products, Less Paperwork, Better Tracking and Inventory Management

The wireless LAN makes possible a level of quality control that contributed to the successful launch of Ford's F-series trucks. "The system lets us correct problems before components leave their specified area," says Ishmael White, Plant Floor Systems Manager. "We don't wait to go back and correct them later, so we can make repairs more reliably. The system also lets us react very quickly to trends that start to develop—say, where the same error is occurring repeatedly—which saves on the time and cost of repairs. Even in the rare case where a defect isn't discovered until later on, the system lets us trace it back to the area where it originated so that we can find out what went wrong and address the problem."

Because all of the information transmitted over the wireless LAN is collected in real time in a central database, inspectors can get the information they need on the spot simply by querying the database—there's no more need to generate reports or tally inspection forms. Most reporting is done on-line, too. The result has been a drastic reduction in paperwork.

Finally, the wireless system has dramatically improved both materials tracking and inventory management, reducing the amount of material tied up in manufacturing by two thirds since 1990.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

INGRAM MICRO INC.
CANADIAN AND U.S. WAREHOUSES

Wireless LAN Helps Warehouse Do the Job Right

The accuracy of inventory tracking used to be a big concern at Ingram Micro, the world's largest distributor of microcomputer equipment. Now, though, a new wireless data collection system has brought overall accuracy close to 100 percent.

APPLICATION

Warehouse Management and Inventory Control

Including two facilities in Canada, 10 in the United States, and more in other countries, Ingram Micro has warehouse space totaling millions of square feet. "When you're moving $8 million of equipment per day, transactions happen very quickly. It's almost impossible to keep track of everything at all times. With the old system, we wouldn't actually lose equipment, but there were times when it was hard to know where things were on paper," says Ingram Micro's director of Canadian operations, Peter Van Bodegom.

Sixty warehouse operators in Canada and hundreds more in the United States now use hand-held computers with integrated scanners (all running off a central mainframe computer at the Nashville, Tennessee, facility) to collect and track warehouse data. "We're currently using wireless data collection in a number of different capacities," Van Bodegom says. One current use is in receiving and putaway. "When we receive product, we use the wireless system to conduct a Stage 1 door log: An operator scans the bar code with the hand-held terminal to record receipt of the order, along with the purchase order number, the bill of lading, the weight, and other information. Then we conduct Stage 2 verification by scanning the product itself; we confirm receipt by the vendor part number, the UPC [universal product code], or the Ingram SKU [stock keeping unit]."

The warehouses are also putting the wireless system to work to improve quality assurance and shipping procedures. When a warehouse fills a customer order, an operator enters the order into the warehouse's system by using a wireless hand-held computer to scan a bar code on the order ticket. After an operator picks a product from inventory and brings it to the shipping department, a shipping clerk scans both the order ticket and the product in the box to compare them. If the bar

codes don't match, the system won't accept the order for shipment. If they do match, the system bills the customer and generates a packing slip that indicates the assigned carrier, and the package goes down the belt for shipment.

The wireless system accommodates both inventory maintenance and perpetual inventory: Rather than conducting inventory annually, the warehouses conduct inventory on one aisle each day.

BENEFITS

Accurate Order Fulfillment and Inventory Control, Better Customer Service, and More

Ingram Micro's wireless quality assurance program has had a major impact on productivity and quality. "Order accuracy has improved dramatically since we started using the wireless system," says Van Bodegom. "In Canada, accuracy is over 99 percent now, even though we're filling between 4,000 and 5,000 orders a day during our busy season, and the only errors we're finding are when a customer ordered the wrong item or a product is defective."

Inventory accuracy is improving too. "Before we implemented a totally wireless solution, variances in inventory were atrocious. But now, inventory accuracy improves every quarter. We expect it to be at 99 percent the next time we complete it."

The wireless system has become critical to Ingram Micro's customer service. "Our customers expect product faster today than they used to, and the wireless system lets us provide the level of service they want. Before, it could take as long as three days before we received an order. Now we receive orders on the same day they're placed. If we receive an order by 2:00 p.m., we'll ship it the same day."

Ingram Micro has found wireless technology to be a tremendous tool. As the company grows and the microcomputing market changes, Ingram Micro keeps finding more ways to use and expand its wireless networks.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

KRAFT CANADA

With Wireless Warehousing System, Inventory Falls into Place

Kraft has been a household word for decades—consumers take home Kraft products from virtually every grocery store, supermarket, convenience store, and discount store across North America. The coordination and planning it takes to move all those products to the stores where consumers buy them could be daunting. Now, though, Kraft Canada's wireless system makes that task a lot less labor intensive than it used to be.

APPLICATION

Tracking Finished Goods through Warehouses

In the early 1990s, Kraft Canada made a commitment to implementing new technology to automate its manufacturing plants and distribution centers. It began with a progressively integrated manufacturing and materials requisitioning and purchasing system, or MRP, in its seven Canadian manufacturing facilities. That system's success spurred Kraft to pilot and then install a wireless data collection and warehouse management system at its Montview distribution center, one of three in Canada. "Although the batch system worked well at our manufacturing facilities, we needed real-time data transmission at our distribution centers. Now our inventory is up-to-the-minute," says Daniel Lanctot, senior systems analyst at Kraft Canada.

Kraft Canada uses the wireless system for everything from receiving and putaway to inventory and quality control. Sixty-five forklift-mounted data terminals and 10 hand-held data terminals with integrated bar code scanners, all running off an IBM AS/400 host computer, dynamically direct forklift operators to complete specific tasks.

From the moment goods arrive at a warehouse until they're shipped, the system tracks their movement. "When product comes in the door," says Lanctot, "an operator scans the bar code tag to transmit the product description, quantity, lot number, and pallet number to the host computer. The host then generates a putaway task indicating the appropriate location, and automatically downloads it to the appropriate forklift operator's terminal."

When an order comes in, the warehouse management system automatically uses inventory rotation dates to generate a picking task, which dynamically directs a forklift operator to start building a load. The forklift operator first scans a bar code that describes the product's location, then scans a bar code on the pallet to verify that they match. Because

the system can tell full pallet picks from multiple product picks, it knows whether to direct the forklift operator to a full pallet pick location or to a case picking location.

Once the forklift operator finishes a load, the dispatcher generates a bill of lading and sends the operator to the correct shipping dock. At the dock, the forklift operator gives the carrier the bill of lading, a warehouse operator scans the load, and the dispatcher confirms that it matches the bill of lading before the carrier takes it away.

Using special re-warehousing and replenishment programs, Kraft even uses the wireless system to optimize space. The programs automatically download trip tasks to forklift operators' terminals, directing them to move pallets according to lot numbers and rotation dates.

BENEFITS

More Efficiency, Higher Productivity, and Dependable Inventory

Inventory accuracy at the Montview distribution center has risen to 98 percent or more, and—because virtually every warehouse function is recorded on-line—Kraft can check inventory status at any time with confidence that it's correct. The re-warehousing and replenishment programs are an effective way to free up space to receive new product. As for customer service, Lanctot says this: "Now we know we're shipping the right product in the right quantity to the right customer at the right time."

Kraft soon afterward installed similar systems at its Lasalle and Cobourg distribution centers. And to enhance service to its customers even further, Kraft Canada is planning to integrate an EDI link (an on-line shipping, tracking, and payment system) into its wireless systems.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

MATSUSHITA ELECTRIC OF CANADA LTD.

Wireless System Boosts Warehouse Volume

In warehouse management, shutting down operations to conduct inventory has always been a fact of life—until now. With a wireless warehouse management system, Matsushita Electric of Canada has swept aside month-end inventory to make room for more sales.

APPLICATION

Automating Every Stage of Warehouse Management and Inventory Control

Matsushita's system consists of a wireless network and warehouse management system operating in an IBM AS/400 minicomputer environment. Workers in four industrial and consumer warehouses use a total of 56 wireless hand-held computers with integrated bar code scanners, controllers, and access points.

Through an electronic data interchange, or EDI, system, Matsushita factories send advanced shipping notices, or ASNs, to Matsushita warehouses on-line. When truckloads or containers arrive at a warehouse, workers scan bar codes on the products to acknowledge receipt and to collect information including product type, the count, the date and time of receipt, and the vessel the products arrived in. The warehouse management system then generates a "license plate," or bar code sticker, that a worker applies to a group of products. When the worker scans the license plate, the system acknowledges receipt. Later, another worker scans the license plate again, and the system specifies a putaway location; on putaway, it automatically updates inventory records.

When an order arrives at a warehouse—on-line, if the customer is set up on Matsushita's EDI system—it goes into a job planning queue for sorting. Then a message on the screen of a picker's hand-held computer dispatches the picker to a product location. For each product model, the picker scans a bar code at the product location and another bar code on the product itself to verify that each is correct, and then he or she enters the amount picked. A message on the computer directs the picker to the next pick.

When the picking is finished, the picker presses a key that indicates he or she is taking the picks to the shipping dock. At the dock, a worker applies a picking license plate that the system generates, scans the license plate, and verifies that the order is complete before it's shipped. Once a carrier signs off on a load, a warehouse worker scans it to con-

firm the order and instantly route it to accounts receivable. The warehouse management system generates an invoice and mails it to the customer—or sends an ASN, completing the process of ordering and shipping entirely on-line.

BENEFITS

Time Saved, Service Improved, Volume and Productivity Multiplied

By putting warehouse management on-line and connecting it to wireless computers, Matsushita shrank the turnaround for moving products from receiving to picking from overnight to just 15 minutes. And because the system tracks picking status on the floor, the person running the shipping and picking area can tell who on the floor will be next in line to take another assignment. That means pickers spend a minimum of time waiting for assignments, and it increases picking capacity. And, says William Austin, logistics manager for Matsushita, "on the dock alone we figure our efficiency has gone up by at least 50 percent. There is no paper, there are no mistakes, there is no manual input, and we don't have to have someone keying in confirmations all day." Automatic routing of orders to accounts receivable makes the warehouses still more efficient.

"Completely automating our inventory system has translated into a gain of more than $12 million a year," adds Austin, by eliminating month-end close-down and giving Matsushita one more selling day per month. Also, because the system updates inventory within 15 minutes of a shipment's arrival at a warehouse, products often are cross-docked, going directly from receiving to picking without going through the regular put-away process.

The wireless system makes customers happier, too, with just about any order shipped the same day—or ready for pickup in just 10 to 15 minutes. Since the wireless system was installed, shipping errors—which had been a fact of life since Matsushita opened its first warehouse 26 years before—have virtually disappeared. "Now everything ships correctly—no model mixes, no product mixes, no incorrect amounts, no incorrect colors." And if a warehouse is sending a customer two or more shipments in one day, it can consolidate the shipments, saving time at the warehouse and saving the customer money.

Although Matsushita hasn't expanded any facilities or added employees, it has multiplied warehouse volume by up to 15 to 20 times, and increased accuracy at every stage to boot.

The success of Matsushita's wireless warehouses has attracted worldwide attention. According to Austin, "Matsushita seems to have become a model for businesses that want to improve their warehouse management and inventory control."

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

MITSUBISHI CATERPILLAR FORKLIFT AMERICA
HOUSTON, TEXAS

Wireless System Lightens the Load of Heavy Equipment Manufacturer

Mitsubishi and Caterpillar formed their joint venture, Mitsubishi Caterpillar Forklift America (known as MCFA), by revamping a plant in Houston and giving it the capacity to custom-build as many as 60 forklifts a day. By doubling the work force overnight and dramatically increasing output, the consolidation put enormous pressure on the plant's work-in-process and employee attendance systems. MCFA's new wireless tracking system took the pressure off.

APPLICATION

Facilitating Work-in-Process and Tracking Time and Attendance

MCFA manufactures custom-built forklifts, not just one standard model: A customer can choose a gas-powered, electric, or diesel engine, for example, or opt for pneumatic or cushioned tires. Assemblers typically do not know what type of unit they will be working on until they receive a work order. Any delay in getting the required parts to assemblers eats up production time.

Before MCFA installed its wireless system, the plant tracked all work-in-process manually. The delay between transactions and data entry made it difficult to track the manufacturing process, accurately forecast production, or adjust for production delays. "When a part came in to the receiving dock, it took up to several days before someone entered that information into the computer system," says Roy McCartney, system architect for the plant's information services. "In the meantime, the assembly line couldn't use the part." And MCFA could only tell a customer that it was either working or not working on the customer's order; it couldn't provide more details on the order's status.

With MCFA's new wireless system, tracking of work-in-process and employee time and attendance are both automatic. Using hand-held wireless computers, workers at the receiving dock key in information about parts received as soon as each part shipment arrives, and workers on the assembly line track work orders in progress.

BENEFITS

Fewer Production Delays, Better Customer Service, and Smooth Handling of a Growing Work Force

Now production delays have declined, the plant operates more efficiently at every stage, and MCFA's customers appreciate the progress reports they get on the status of their orders. Plus, the wireless system has helped management smoothly handle the influx of new employees at the plant. McCartney goes so far as to say that "with the plant's growth in product output and employees, it would have been impossible to continue manual tracking."

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

OCEAN SPRAY
KENOSHA, WISCONSIN

Wireless LAN Makes Productivity Jump at Juice Warehouse

Ocean Spray has six regional manufacturing and warehousing distribution centers. While each center produces juice from locally grown fruit, it also distributes the full Ocean Spray product line in its region, and as a result each warehouse handles a growing volume of interwarehouse shipments. Ocean Spray's Kenosha, Wisconsin, warehouse put a wireless LAN on the job, with profitable results.

APPLICATION

Automating Warehouse Management

Before Ocean Spray's Kenosha plant installed its wireless LAN, it dedicated two people to walking around the 300,000-square-foot warehouse just to find open storage locations for incoming pallet loads. And when it was time to pick cases of juice products, workers had trouble reading the pallet case markings. Finally, tracking shipments required spending many hours reviewing paperwork and determining who had received what products from which lots.

When the Kenosha warehouse's managers faced a 15 percent increase in case volume and a 10 percent increase in stock keeping unit, or SKU, count, they decided it was time to automate inventory information management. Now every lift truck in the warehouse is outfitted with a wireless data communication terminal and scanner, and every storage location is bar coded, as is every pallet load arriving from another warehouse. A warehouse management system coordinates activities from receiving through invoicing. The system runs on a server at Kenosha that is fully integrated with the mainframe at Ocean Spray's corporate headquarters in Middleboro, Massachusetts.

To automate receiving and putaway, each pallet label is bar coded with the product's identification number, the product code date or expiration date, the plant of manufacture, the line of manufacture, and a sequentially assigned serial number. When a pallet load arrives from another warehouse, a lift truck operator in the receiving department scans the label. The wireless terminal sends that information to the warehouse management system, which immediately designates a storage location and relays it back to the wireless terminal on the lift truck. Every storage location is identified by a bar code label that is suspended from the ceiling (for floor locations) or attached to a rack face. The operator scans that bar code to confirm putaway in the correct location.

Automated order fulfillment starts when the mainframe at headquarters receives orders though Ocean Spray's electronic data interchange, or EDI, network, and releases them to warehouses. Kenosha's system manages order picking, balances work loads, selects pick sequences for lift truck operators, and then releases orders for picking.

Each line item and the quantity to be picked appear on the designated lift truck's wireless terminal. To confirm accuracy, the operator scans the bar code label on the full pallet or (for less-than-full-pallet picks) at the rack location. The wireless terminal directs the operator to a dock door for immediate loading on an over-the-road trailer. The system uses the inventory information collected as the warehouse operators scan bar codes to automatically generate a packing list and bill of lading and to send confirmation of line items picked and shipped to the mainframe at headquarters for invoicing.

BENEFITS

Higher Productivity, Greater Inventory Turnover, Better Business Data

The benefits of the Kenosha warehouse's wireless, automated system went beyond eliminating the old manual system's inefficiency. In the first year after it installed the system, Kenosha shipped an additional 1.8 million cases of products in 2,200 fewer worker hours. Hourly productivity increased from 451 to 550 cases handled per worker. In addition, inventory turnover increased as inventory fell by 121,000 cases and inventory accuracy now exceeds 98 percent.

The wireless system also gives headquarters better information. Ocean Spray can now trace any lot by customer within minutes, and "the wireless system makes the data in our corporate system as current as the last bar code scanned on the floor," says Pete Stirling, Ocean Spray's manager of application development.

Ocean Spray is in the process of installing wireless systems at its other regional warehouses.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

ORBIT IRRIGATION PRODUCTS
NORTH SALT LAKE, UTAH

Wireless System Gets Products from Warehouse to Customers on Demand

Orbit Irrigation Products is an industry leader in both residential and commercial markets. The 300-employee manufacturer distributes products to all 50 states and many countries from four distribution centers, including its main center in North Salt Lake, Utah. Orbit's business is highly seasonal, and during spring and summer demand can increase rapidly. Now a wireless network lets Orbit process and ship orders as quickly as necessary to meet that demand.

APPLICATION

Automating Warehouse Operations and Eliminating Delays

During lulls in business, Orbit's paper-based inventory control card system was adequate, but during peak selling seasons, it was slow and inefficient enough to cause problems, and rapid sales growth was making things worse. Phantom or misplaced inventories hamstrung operations in Orbit warehouses because they were difficult and time consuming to locate. Forklift drivers would roam aisles at random, looking for places to stock overhead inventories. And every shipping delay potentially led to an order being cancelled and business lost to a competitor.

"We needed a system that ensured that our inventory was accurate and directed our workers as efficiently as possible, but that didn't break the bank," says Shawn Stephens, Orbit's warehouse inventory sales manager. "A wireless system, which would allow real-time warehousing transactions and bar code verifications, was the only way we could both keep down labor and inventory costs and raise customer satisfaction."

Orbit's new warehouse system includes wireless hand-held computers equipped with long-range scanners that can read bar codes even on upper storage locations. Warehouse operators use the system to transmit receiving, putaway, picking, and shipping data to the central warehouse management system; with each warehouse transaction, the system updates inventory automatically.

BENEFITS

Higher Productivity, Reliable Inventory from a System That Pays for Itself

Orbit's 65 Utah warehouse employees now process 20 to 30 percent more orders every day. And now that warehouse operators can find products on demand, picking and shipping delays are a thing of the past.

"Before we computerized our warehousing system, we had one person searching the aisles daily looking for products," says Stephens. "We just don't need to do that anymore." The new wireless system lets Orbit use random putaway as well as dedicated putaway, so while Orbit is making better use of storage space and doubling the hourly output of forklift operators, it's eliminating product "outs" in dedicated pick locations.

Adds Stephens: "We're on schedule to have the system pay for itself in less than 18 months."

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

PAPER CONVERTING PLANT

Wireless LAN Turns Forklift Trucks into Mobile Offices

Material handlers at a U.S. paper converting plant have the ultimate in office convenience: Their forklift cabs are their offices. They can inventory products, scan bar codes, generate labels, send mail, write documents, use spreadsheets, check on the status of orders, and fax messages—all without leaving their trucks.

APPLICATIONS

Making Production, Inventory, and Office Applications Available throughout a Plant

The plant converts large parent rolls of coated paper into 2,500-pound skids of sheeted paper that printers use for glossy publications and catalogs. Material handlers work 24 hours a day, seven days a week, to move and inventory incoming rolls and finished skids.

The cab of each electric forklift at the plant has a custom-built arm for a laptop and a DC-to-AC transformer that supplies power from the truck to the laptop. Seven access points, mounted in the ceiling on columns and distributed evenly around the 500-foot-square building, connect 20 of these laptops, each equipped with a wireless PC card and a long-range bar code reader, to the plant's wired network. Workers can move from one coverage area to another without losing the network connection.

Using the laptops, "forklift operators can enter information into our system without ever having to touch a piece of paper," says Ben Spalding, the plant's information service leader. When forklift operators unload a roll of paper from a truck or rail car, they scan the roll's bar code. All bay locations are bar coded as well, so when operators take a roll over to a bay, they simply aim the reader at the floor to record exactly where they put the roll. The system works the same way for finished products, which are also bar coded. The laptop generates product labels, too. And inventory is automatically updated as forklift operators do their work.

Warehouse workers also have access to the inventory system through a PC (also with a wireless PC card) on a rolling stand. Because, like the laptops, the PC is connected to the network through access points rather than through wiring, workers can move it around the building and plug it in where it's needed.

The company takes orders at a customer service office in Westbrook, Maine, and sends them electronically over a wide area network. Using the laptops, plant workers can log into the corporate order management system to see order status in real time. The laptops also give plant workers access to a variety of horizontal applications loaded over the network, including mail, word processing, and spreadsheet programs.

BENEFITS

Higher Efficiency and Lower Costs

Constant access to information, resources, and applications on the network have made the plant more efficient and workers more productive. Forklift operators and other workers can handle plant operations and perform daily office communications from anywhere in the plant. As Spalding says, "On the plant's wireless LAN, you can do anything from a forklift that you can do from a desktop. You can literally send a fax from a forklift."

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

Utilities

HYDRO MISSISSAUGA
MISSISSAUGA, ONTARIO, CANADA

Wireless System Brings Accessibility and Reliability to Electric Utility's Inventory

Hydro Mississauga purchases power from another utility and converts it to usable voltage for residential and commercial customers in Mississauga, Ontario, Canada. With 300 employees and 138,000 customers, Hydro Mississauga is the second largest power utility in Ontario, and the most profitable. A new wireless inventory and warehouse management system is helping to keep it that way.

APPLICATION

Inventory Management

Despite the best efforts of the experienced and knowledgeable personnel that Hydro Mississauga relied on to find materials in its warehouse, the utility's paper-based inventory and warehousing system hampered operations. Paper-based inventorying was slow and inaccurate, and it delayed reporting so that inventory records were never current or reliable. Inventory shortages, late paperwork, and delays for tools and replacement parts that line crews needed to make critical field repairs were all unavoidable problems. Typically, 40 to 50 service crews would wait as long as two hours for tools and parts before leaving the warehouse in the morning.

Wanting to account for critical tools and important inventory items like cable reels, transformers, and water heaters accurately, and at any time, Hydro Mississauga integrated a wireless warehouse management system with its host minicomputer. Now warehouse operators use handheld wireless terminals equipped with bar code scanners to track inventory in real time. Service crews use the bar code scanners to build their own orders at the end of their shift, so that warehouse operators can have their orders ready for pickup first thing next morning.

BENEFITS

Huge Savings from Leaner Inventory, Faster Inventory Turnover, and Real-Time Tracking

Since they no longer waste time waiting at the warehouse in the morning, Hydro Mississauga's 40 to 50 service crews arrive at each job site one to two hours earlier each day. Plus, Hydro Mississauga has reduced

its inventory by $300,000 (from $5.7 million to $5.4 million), doubled inventory turnover, and saved money by eliminating manual data entry. Hydro Mississauga estimates that its wireless system will pay for itself in six months.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com

Education and Research

CARNEGIE MELLON UNIVERSITY
PITTSBURGH, PENNSYLVANIA

Major University Provides Platform for Wireless Research

Carnegie Mellon University is ranked among the nation's top 20 private research universities. Its Information Networking Institute, the first research and education center devoted to information networking, received an endowment from the National Science Foundation to create an experimental high-speed wireless network. Dubbed "Wireless Andrew," the network is now in the testing stage.

APPLICATION

Linking Wired and Wireless Networks

Wireless Andrew is a 2-megabit-per-second wireless local area network connected through 100 access points (covering six buildings on the campus) to the wired Andrew network, a high-speed Ethernet backbone linking buildings across the Carnegie Mellon campus. The combination of networks gives high-speed access to any user with a portable computer and a wireless LAN card from any building covered by access points. In addition, a low-bandwidth wide area network that covers the greater Pittsburgh area provides researchers and others with off-campus wired access to campus networks. The university tested the current setup with over 40 mobile units before allowing general use by researchers and students in February 1997.

Campus network services include e-mail and file transfer, access to audio and image data, access to the library and other databases, and full Internet access.

BENEFITS

Increased Access to Campus Networks and Creation of Leading Research Platform

The Institute's wireless initiative not only serves the campus community by increasing high-speed access to campus networks—it also provides an infrastructure for leading research in wireless communication. As the university's Dr. Ben Bennington points out, "What makes us different from other wireless technology customers is that we're not implementing an application; we're implementing infrastructure, a kind of 'honey pot' to attract people to mobility research."

In the area of infrastructure, Carnegie Mellon has anticipated the need for the next generation of systems to integrate wired and wireless

networks by giving researchers a platform for developing and testing "middleware"—software that allows seamless access to the various wired and wireless networks which a roaming computer encounters.

As for mobility research, the system will provide a major test bed for Carnegie Mellon and its sponsors, giving researchers in many fields, inside and outside the university, a way to explore the uses of mobile computing. Programs include systems research, development of computer platforms for mobile use, compression research, and research on the human factors of mobile computing. The Institute's ongoing development is resulting in numerous innovative uses of wireless LANs, including emergency response, health care, and vehicle maintenance. One project involves communication with trains to download diagnostic data. Another involves "wearable computers"—a project for developing innovative maintenance systems that free technicians' hands while still giving them access to engineering drawings and other information.

WLANA
Wireless LAN Alliance
409 Sherman Avenue
Palo Alto, CA 94306
Phone: (415) 328-5555
Fax: (415) 328-5016
Web: www.wlana.com
E-mail: info@wlana.com